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class: Calculus - Single Variable

Ghrist - UPenn

Taylor Series "about $x=a$"

* infinite (series) polynomial is anchored at $x=a$
* very "best" approximations are closest to a
  ↳ need fewer terms

$$T(x) = \sum_{K=0}^{\infty} \frac{f^{(K)}(a)}{K!}(x-a)^K$$

Not the (K) power but the Kth derivative

Convention
0th derivative = original function

by def^n $0! = 1$

ASIDE: a Taylor Series about $x=0$ is sometimes called a Maclaurin Series

Calculate the Taylor series around $x=0$ for $\cos x$.

		$f^{(k)}(0)$
	$\cos(x)$	$\cos(0)=1$
$f^{(1)}(x)$	$-\sin(x)$	$-\sin(0)=0$
$f^{(2)}$	$-\cos(x)$	$-\cos(0)=-1$
$f^{(3)}$	$+\sin(x)$	$\sin(0)=0$
$f^{(4)}$	$\cos(x)$	$\cos(0)=1$

$$\cos x = \frac{1}{0!}x^0 + \frac{0}{1!}x^1 + \frac{-1}{2!}x^2 + \frac{0}{3!}x^3 + \frac{1}{4!}x^4 + \ldots$$

$$= 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \frac{x^8}{8!} + - \cdots$$

Appl

$$\lim_{x\to 0} \frac{1-\cos x}{x} = \lim_{x\to 0} \frac{+\frac{x^2}{2!} - \frac{x^4}{4!} + \frac{x^6}{6!} - \cdots}{x}$$

$$= \lim_{x\to 0} \frac{x}{2!} - \frac{x^3}{4!} + \frac{x^5}{6!} \cdots = 0$$

9 $\cos(\pi x)$

$f(x) = \cos(\pi x)$ 1

$f'(x) = -\sin(\pi x)(\pi)$ 0

$f''(x) = -\cos(\pi x)(\pi)^2$ $-\pi^2$

$f'''(x) = \sin(\pi x)(\pi)^3$ 0

$f''''(x) = \cos(\pi x)(\pi)^4$ π^4

etc

$$\sum_{k=0}^{\infty} \frac{f^{(k)}(0)}{k!} x^k$$

$$\frac{1}{1}$$

$$1 - \frac{\pi^2 x^2}{2!} + \frac{\pi^4 x^4}{4!} \ldots \text{etc}$$

Jan 11-8:16 AM

6.6
33)

$\int te^{-t}\,dt$

YOU CAN'T DO THIS (yet).

"CAS" means calculator

YOU CAN find

$\int_a^b te^{-t}\,dt$ on calculator

function

variable. like (dx)

fnInt(Xe^{-X} , X , a , b)

math 9

$|\sim|$ = abs($\sim$) = MATH → NUM → 1